FLOOD INSURANCE STUDY

OHIO COUNTY, KENTUCKY AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
BEAVER DAM, CITY OF	210184
HARTFORD, CITY OF	210357
MCHENRY, CITY OF	210233
ROCKPORT, CITY OF	210245
UNINCORPORATED AREAS	210183

SEPTEMBER 29, 1989

Federal Emergency Management Agency

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	2
2.4	Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	5
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	6
4.1	Floodplain Boundaries	6
4.2	Floodways	7
5.0	INSURANCE APPLICATION	7
6.0	FLOOD INSURANCE RATE MAP	7
7.0	OTHER STUDIES	8
8.0	LOCATION OF DATA	8
9.0	REFERENCES AND BIBLIOGRAPHY	8

TABLE OF CONTENTS (continued)

Page

FIGURE

Figure 1 - Vicinity Map 3

TABLES

Table 1 - Summary of Discharges 5

Table 2 - Community Map History 9

EXHIBITS

Flood Profiles

Rough River Panels 01P-02P
Green River Panels 03P-04P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

Elevation Reference Marks

FLOOD INSURANCE STUDY

OHIO COUNTY, KENTUCKY
AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the geographic area of Ohio County, Kentucky, including the Cities of McHenry, Beaver Dam, Hartford, and Rockport and the Unincorporated Areas of Ohio County (hereinafter referred to collectively as Ohio County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study revises and supersedes previous Flood Insurance Rate Maps for the Cities of Beaver Dam and Hartford, Kentucky (References 1 and 2). This information will be used by the communities to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Louisville District, (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1822, Project Order No. 1. This study was completed in December 1986.

1.3 Coordination

In June 1985, streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, FEMA, and Ohio County.

On November 1, 1988, the results of this Flood Insurance Study were reviewed and accepted at final coordination meetings attended by representatives of the Study Contractor, FEMA, and the communities.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Ohio County, Kentucky. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of the Green River and the Rough River was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Insurance Rate Map for the City of Beaver Dam (Reference 1) and the Flood Hazard Boundary Map for Ohio County, Kentucky (Reference 3) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through December 1991. The scope and methods of study were proposed to and agreed upon by FEMA and Ohio County.

2.2 Community Description

Ohio County is in western Kentucky in the western coal fields physiographic region. The county is approximately 130 miles southwest of the City of Lexington, Kentucky, and about 40 miles northwest of the City of Bowling Green, Kentucky.

Ohio County is bordered by Daviess and Hancock Counties on the north, Breckinridge and Grayson Counties on the east, Butler and Muhlenberg Counties on the south, and McLean County on the west.

Ohio County has an area of 596 square miles and is served by U.S. Route 62, the CSX railroad, and the Illinois Central Railroad. The 1980 population of Ohio County was reported as 21,765 (Reference 4).

2.3 Principal Flood Problems

Most of the flood problems in Ohio County are caused by overflow of the Green and Rough Rivers. Although Ohio County has extensive floodplains, flood damage to structures is not significant because most of the area is agricultural.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

OHIO COUNTY, KY
AND INCORPORATED AREAS

APPROXIMATE SCALE

0 4 8 16 24 MILES

VICINITY MAP

2.4 Flood Protection Measures

There are no known flood protection projects within Ohio County. However, there are 4 flood control reservoirs upstream of the county that include Nolin River Lake, Green River Lake, Barren River Lake in the Green River basin, and Rough River Lake on the Rough River. While the reservoirs reduce flooding in Ohio County, they do not provide flood protection from major floods such as the 100-year event. The reduction in flooding afforded by these reservoirs depends on the magnitude of runoff from areas below the dams.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Discharge-frequency values were developed from recorded data at 12 gage stations within the Green River basin. During the period of record, Green, Nolin, Barren, and Rough River Lakes were formed by flood control structures. For the prior existing conditions analysis, the record data that reflected the existence of those lakes, all of which are outside Ohio County, were adjusted before they were used with data from earlier years.

Final existing conditions (modified) discharge-frequency curves were developed through paper operation of the four lake projects, using data from October 1939 to the present. Resultant lake holdouts were routed through each gage location to determine the modified annual events. The final modified discharge-frequency values for the Green River study reach were based on analyses of data from four gages on the Green River and two gages on the Rough River in Ohio County. Pertinent discharge values

were taken from the Green River relationship developed using data from those gages. This study provided frequency-discharges versus drainage area relationships based on similar hydrologic characteristics.

Bulletin No. 17B guidelines (Reference 5) were used for the above calculations. The final discharge versus drainage area relationships were determined by omitting low and high outliers, weighting with the generalized skew, and adjusting to agree more closely with historical floods where possible.

Peak discharge-drainage area relationships for the 100-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
GREEN RIVER		
at Calhoun (Lock 2)	7,566	82,900
at Paradise	6,182	85,500
at Woodbury (Lock 4)	5,404	99,000
at Brownsville (Lock 6)	2,762	62,900
ROUGH RIVER		
near Dundee	757	23,000
at Falls of Rough	504	6,800

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross section data were obtained by field survey and supplemented by photogrammetric mapping (Reference 6). All bridges and culverts were field surveyed to obtain elevations and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") used in the hydraulic calculations were chosen by field observation and based on engineering judgment. For the Green River, values range from 0.035 to 0.04 for the main channel and average 0.07 for the overbank areas. For the Rough River, the values range from 0.043 to 0.057 for the main channel and from 0.047 to 0.065 for the

overbank areas. Water-surface profiles were developed using the HEC-2 step-backwater computer model (Reference 7). Profiles were determined for the 100-year flood and calibrated against known flood profiles. Profiles were also developed for the 10-, 50-, and 500-year floods, but no adjustments for known high-water marks were made. The starting water-surface elevations were calculated based on the slope-area method.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 6).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Insurance Rate Map for the City of Beaver Dam (Reference 1) and the Flood Hazard Boundary Map for Ohio County (Reference 3).

4.2 Floodways

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

Floodways have not been shown or computed for this community. Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than a 1.0-foot increase in the base flood elevations at any point within the community.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current Flood Insurance Rate Map presents flooding information for the geographic area of Ohio County. Previously, separate Flood Hazard Boundary Maps and/or Flood Insurance Rate Maps were prepared for each flood-prone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 2, Community Map History.

7.0 OTHER STUDIES

The Flood Insurance Studies published for Daviess and Butler Counties, Kentucky (References 8 and 9) are in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Insurance Rate Maps for the Cities of Beaver Dam and Hartford (References 1 and 2) and the Flood Hazard Boundary Maps for Ohio County and the Cities of McHenry and Rockport, Kentucky (References 3, 10, and 11).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

9.0 REFERENCES AND BIBLIOGRAPHY

1. Federal Emergency Management Agency, Flood Insurance Rate Map, City of Beaver Dam, Ohio County, Kentucky, September 1985.

2. ————, Flood Insurance Rate Map, City of Hartford, Ohio County, Kentucky, September 1985.

3. U.S. Department of Housing and Urban Development. Federal Insurance Administration, Flood Hazard Boundary Map, Ohio County, Unincorporated Areas, Kentucky, December 1977.

4. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Kentucky, Washington, D.C., February 1982.

5. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
CITY OF BEAVER DAM	MAY 31, 1974	FEBRUARY 27, 1976	SEPTEMBER 27, 1985	
CITY OF HARTFORD	SEPTEMBER 15, 1978		SEPTEMBER 4, 1985	
CITY OF MCHENRY	OCTOBER 25, 1974		SEPTEMBER 29, 1989	
CITY OF ROCKPORT	FEBRUARY 1, 1974	JULY 9, 1976 MARCH 21, 1980	SEPTEMBER 29, 1989	
UNINCORPORATED AREAS	DECEMBER 2, 1977		SEPTEMBER 29, 1989	

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

OHIO COUNTY, KY
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

6. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 Feet: Utica, Kentucky, 1953; Pleasant Ridge, Kentucky, 1953; Dundee, Kentucky, 1953; Olaton, Kentucky, 1954; Falls of Rough, Kentucky, 1963; Livermore, Kentucky, 1952; Equality, Kentucky, 1952; Hartford, Kentucky, 1954; Horton, Kentucky, 1954; Central City West, Kentucky, 1963; Central City East, Kentucky, 1963; Paradise, Kentucky, 1963; Cromwell, Kentucky, 1954; Flener, Kentucky, 1973; Rochester, Kentucky, 1953; South Hill, Kentucky, 1953.

7. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

8. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Daviess County, Unincorporated Areas, Kentucky, September 1980.

9. ————, Flood Insurance Study, Butler County, Unincorporated Areas, Kentucky, February 1989.

10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of McHenry, Ohio County, Kentucky, October 1974.

11. Federal Emergency Management Agency, Federal Insurance Administration, Flood Hazard Boundary Map, City of Rockport, Ohio County, Kentucky, March 1980.

ELEVATION REFERENCE MARKS

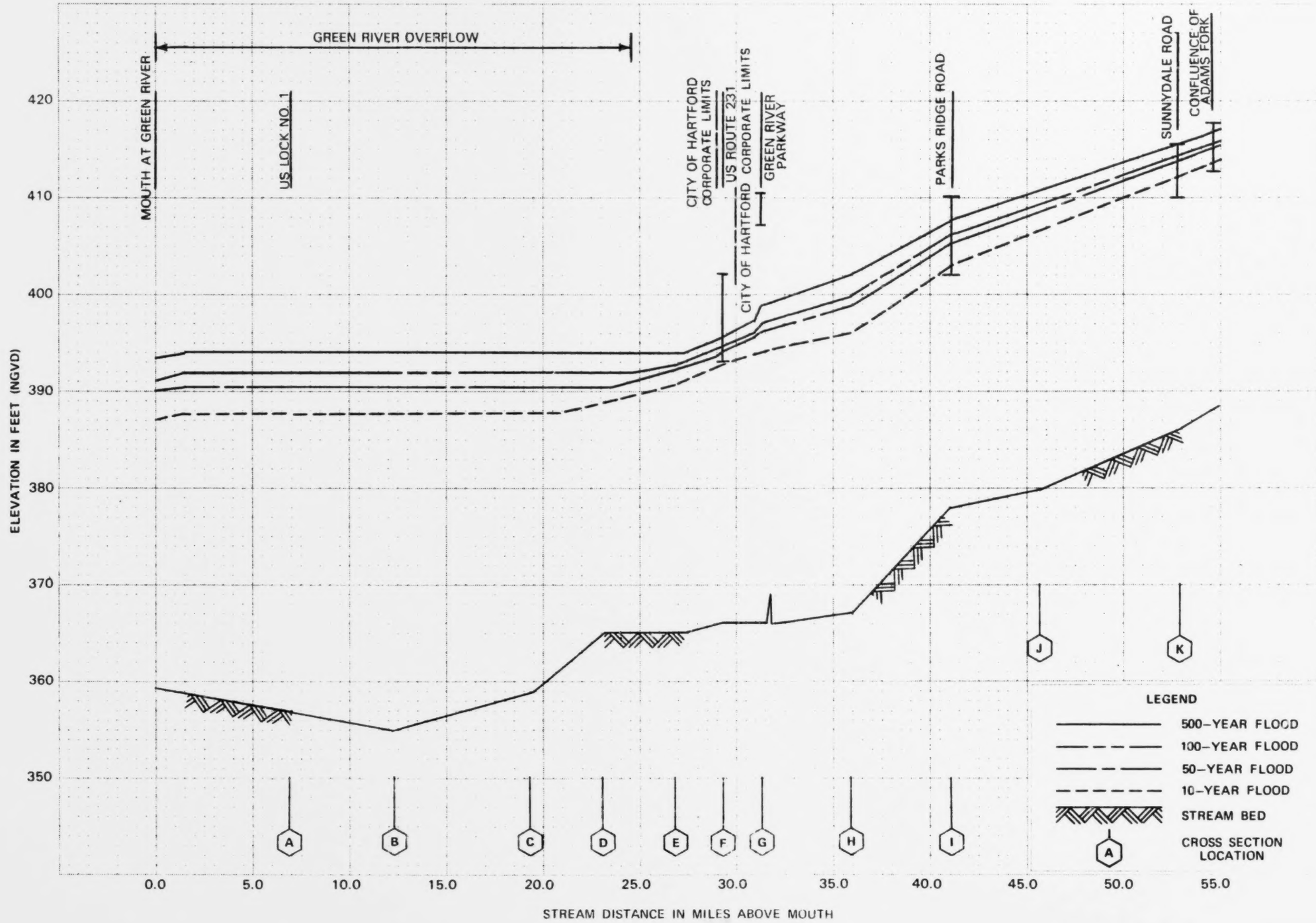
REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0075	386.192	U.S. Geological Survey (USGS) standard tablet stamped "TT 103 HF 1950 386" set in concrete post located about 1,000 feet east of State Route 136 bridge over Barnett Creek, 28 feet south of intersection of Heflin Maxwell Road and State Route 136
2	0075	389.455	USGS standard tablet stamped "83 JDN 1950 390" set in concrete post located along State Route 136 about 310 feet east of southeast corner of State Route 136 bridge over Hanley Branch, 4 feet northeast of power pole
3	0150	390.93	cap of pipe located on west bank of the Green River approximately 1.3 miles upstream of Livermore, 10 feet from top of riverbank, 50 feet upstream of forked elm tree on bank, 8 feet downstream of slough, 7 feet landward of 36-inch elm
4	0150	387.61	cap of pipe located on west bank of the Green River approximately 1.5 miles west of intersection of Cave Hill Road and River Road, 12 feet upstream of bank of slough, 10 feet upstream of barbed wire fence, 25 feet upstream of 33-inch sycamore
5	0150	388.45	cap of pipe located on west bank of the Green River, 175 feet upstream of CSX railroad bridge, about 125 feet from top of riverbank, 3 feet downstream of wire fence, 3 feet landward of wire fence
6	0150	388.294	cap of pipe located on east bank of the Rough River about 12 miles upstream of Lock and Dam No. 1, about 50 feet from top of bank, about 3 feet downstream of fence, about 25 feet landward of mulberry tree

ELEVATION REFERENCE MARKS (Continued)

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
7	0250	410.718	U.S. Coast and Geodetic Survey standard tablet stamped "D 73 1935" set in concrete post projecting 2 feet above ground located on east bank of the Green River at State Route 403 ferry landing 48.2 feet north of centerline of State Route 403
8	0155	396.777	USGS standard tablet stamped "P 79 1937" set in top of concrete post located 57.6 feet south of southwest corner of Hartford-Centertown Road bridge over CSX railroad, 30 feet west of centerline of road, 9.2 feet southeast of southeast rail of CSX railroad
9	0100	426.337	USGS standard disk set in top of wingwall located at northwest end of northeast abutment of State Route 69 bridge over the Rough River
10	0100	419.769	USGS standard disk stamped "W 79 1935" set in top of concrete post located about 400 feet along unnamed road from intersection with State Route 69, about 49 feet north of centerline of road
11	0100	409.969	cap of pipe located about 40 feet northeast of intersection of Sunnydale Road and Renfrow Hill Road, about 20 feet south of top of bank of the Rough River
12	0100	428.494	cap of pipe located about 150 feet northwest of intersection of Dundee Narrows Road and Baugha Road, about 30 feet southwest of top of bank of the Rough River, about 25 feet west of well

ELEVATION REFERENCE MARKS (Continued)

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
13	0125	423.50	cap of pipe located along north bank of the Rough River about 1,300 feet upstream of State Route 919 bridge over the Rough River, 50 feet from top of north bank, about 15 feet from centerline of State Route 919, about 15 feet downstream of 12-inch hickory
14	0125	425.922	cap of pipe located on north bank of the Rough River about 1.75 miles upstream of Illinois Central Railroad, about 25 feet upstream of ditch and fence line, about 35 feet landside of 24-inch beech
15	0225	398.524	USGS tablet set in concrete post stamped "JDN 1950 399" located along State Route 369 about 0.9 mile north of the Green River, about 2,000 feet south of intersection of State Route 369 and Porter Road



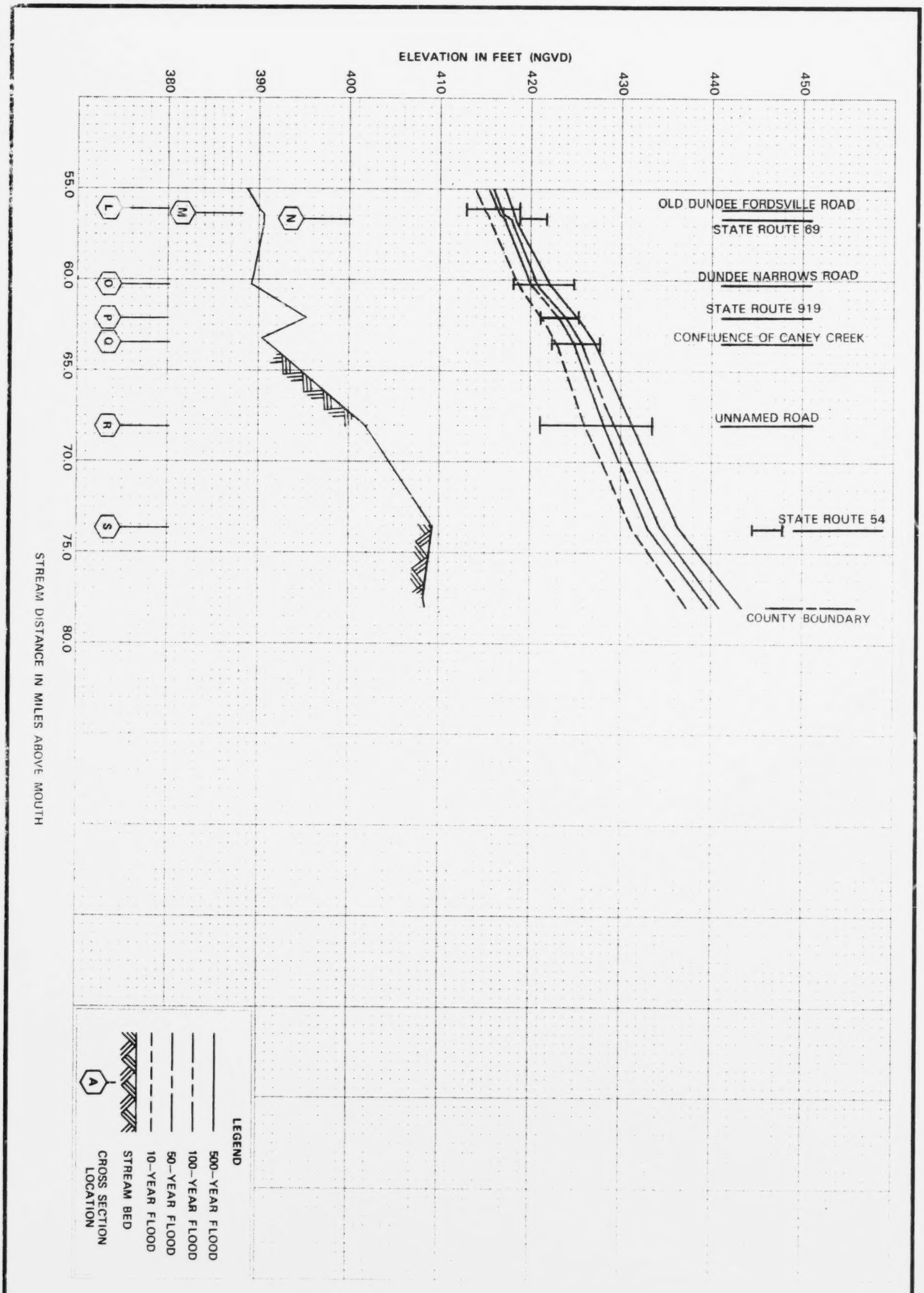
FLOOD PROFILES

ROUGH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

OHIO COUNTY, KY AND INCORPORATED AREAS

01P



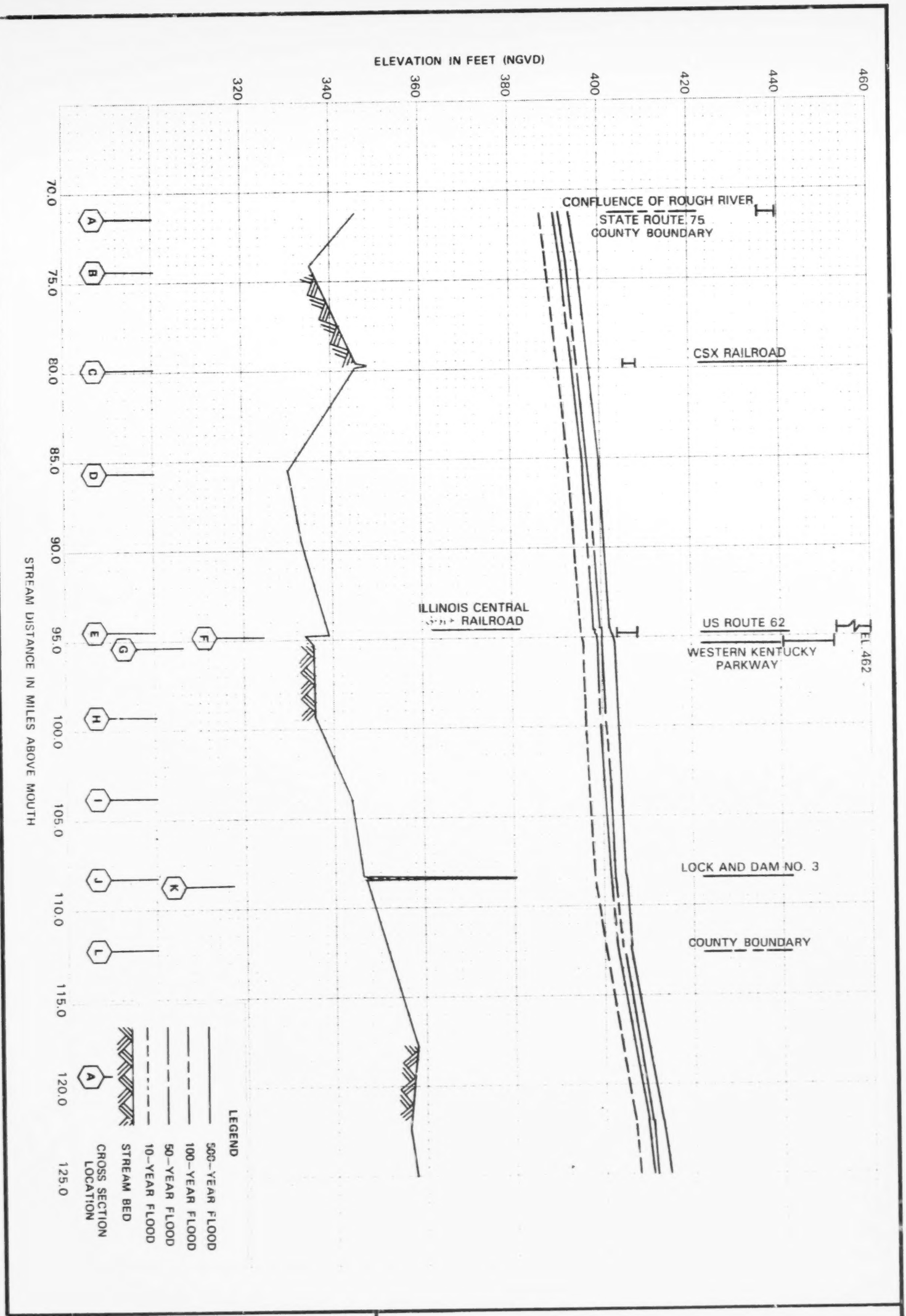
02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

OHIO COUNTY, KY
AND INCORPORATED AREAS

FLOOD PROFILES

ROUGH RIVER



03P	FEDERAL EMERGENCY MANAGEMENT AGENCY OHIO COUNTY, KY AND INCORPORATED AREAS	FLOOD PROFILES GREEN RIVER

FLOOD PROFILES

GREEN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

OHIO COUNTY, KY
AND INCORPORATED AREAS

04P